OLIGOTROPHUS APICIS SP. N., A MIDGE INJURIOUS TO JUNIPERS; WITH KEY TO SPECIES OF *OLIGOTROPHUS* FOUND IN THE UNITED STATES[1, 2, 3]

(DIPTERA: CECIDOMYIIDAE)

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ABSTRACT

A new species of midge is described and named *Oligotrophus apicis* (Diptera: Cecidomyiidae). The life history of *O. apicis* is given with an illustrsted key to the species of *Oligotrophus* recognized in the United States with information on their distribution.

In August, 1952, Dr. Ralph B. Neiswander observed injury to Canaert Redcedar, *Juniperus virginiana* 'Canaertii', in Lake County, Ohio, caused by midge larvae. This insect was identified by Dr. Richard H. Foote of the United States National Museum as *Oligotrophus* sp. This paper describes a new species of *Oligotrophus*, presents additional information on its life history, and includes a key to species of the genus known to occur in the United States.

Prasad and Grover (1963) have reviewed the nomenclature as applied to the male genitalia of the Cecidomyiidae. A summary based primarily on their work

TABLE 1

Comparison of six terminologies as applied to the male genitalia of the Cecidomyiidae

Foote (1956)	Pritchard (1953)	Felt (1925)	Prasad and Grover (1963)	Edwards (1938)	Kieffer (1913)
10th tergite	10th tergite	dorsal plate	superior plate	10th tergite	lambella superieure
10th sternite	10th sternite	ventral plate	inferior plate	10th sternite	lambella inferieure
basistyle	basiforceps	basal clasp segment	basal segment	coxite	basal des forcipules
dististyle	distiforceps	terminal clasp segment	terminal segment	style	terminal des forcipules
style or aedeagus	tegmen	style	aedeagus or sheath	tegmen or penis-sheath	stylet
style or aedeagus	genital rod	style	aedeagus	genital rod	stylet
no name given	no name given	harpes	parameres	probably parameres	appendices ventraux

is given in table 1. In order to avoid confusion, the terminology used by Foote (1956) has been followed throughout this paper.

In the description, measurements are averages of the type series.

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Oligotrophus apicis sp. n.

Male.—Head (fig. 1) 0.279 mm high, 0.343 mm wide from anterior view; eyes not meeting above bases of antennae, separated by a distance of 0.029 mm, distance varies from 0.016 mm to 0.069 mm; facet width 0.012 mm. Scape of antenna subtriangular, 0.071 mm wide at distal margin, length 0.056 mm; pedicel subglobular, 0.060 mm wide at proximal margin, length 0.042 mm; flagellum of 11 to 12 segments usually 12, which decrease slightly in length and width from base to apex; first flagellar segment with distal stem sessile; fifth flagellar segment (seventh antennal segment) (fig. 2) with basal enlargement 0.039 mm wide, 0.058 mm in length, with a row of stout setae on proximal third, with long fine setae of length 0.099 mm on the distal half, distal stem length 0.028 mm with subapical expansion width of 0.018 mm; terminal segments occasionally fused; terminal segment at greatest width 0.029 mm; length of 0.037 mm, with blunt point at apex, subterminal segment 0.033 mm wide, length of basal enlargement 0.044 mm. Palpus (fig. 3) three-segmented, with fine setae and a few bristles, proximal segment length 0.021 mm, second segment 0.031 mm, third 0.029 mm, second segment widest with width of 0.029 mm. Halteres thickly set with narrow, pointed scales of dark, straw-brown color. Coxa and trochanter lack scales, remaining leg segments thickly set. Hind femur length 0.508 mm, tibia 0.470 mm, proximal tarsus length 0.066 mm, second 0.231 mm, third 0.143 mm, fourth 0.098 mm, fifth 0.071 mm; fore, mid, and hind claws simple; pulvillus length 0.022 mm equal to width, longer than claws (fig. 4). Wing length 1.42 mm as shown in figure 5, greatest width 0.722 mm, posterior margin fringed with long setae; R_1 ending in costa in basal half, Rs terminates costa at wing tip; M very weak not extending to wing margin, distal half of Cu becoming extremely weak, branches do not appear to extend to wing margin. Terminalia (figs. 6, 7) with basistyle length 0.187 mm, greatest width 0.085 mm; dististyle length 0.078 mm, width 0.033 mm, bluntly rounded distally with short, dense bristles. Tenth tergite bilobed with rounded apices, lobe length 0.056 mm, greatest lobe width 0.055 mm; tenth sternite length from apex to connection with tenth tergite 0.052 mm, width at connection with tenth tergite 0.056 mm, equal in height to tenth tergite or nearly so, with rounded apex; aedeagus curved proximad; at base of aedeagus a paired structure "A," length 0.072 mm, greatest width of one structure 0.021 mm. Total length about 1.53 mm.

Female.—Similar to male with some exceptions; eyes separated by a distance of 0.018 mm above bases of antennae, varies from 0.015 mm to 0.021 mm; flagellum of 10 to 12 segments, usually 11 which are nearly sessile; fifth flagellar segment (fig. 8) with basal enlargement length 0.045 mm, width 0.037 mm, with a row of stout setae on proximal third, with short fine setae of length 0.018 mm on distal half, distal stem length 0.003 mm, greatest width 0.010 mm, terminal segment length 0.045 mm, width 0.029 mm; third palpus length 0.036 mm; dorsum of terminal abdominal segment with short paired lobes (fig. 9). Total length about 1.65 mm.

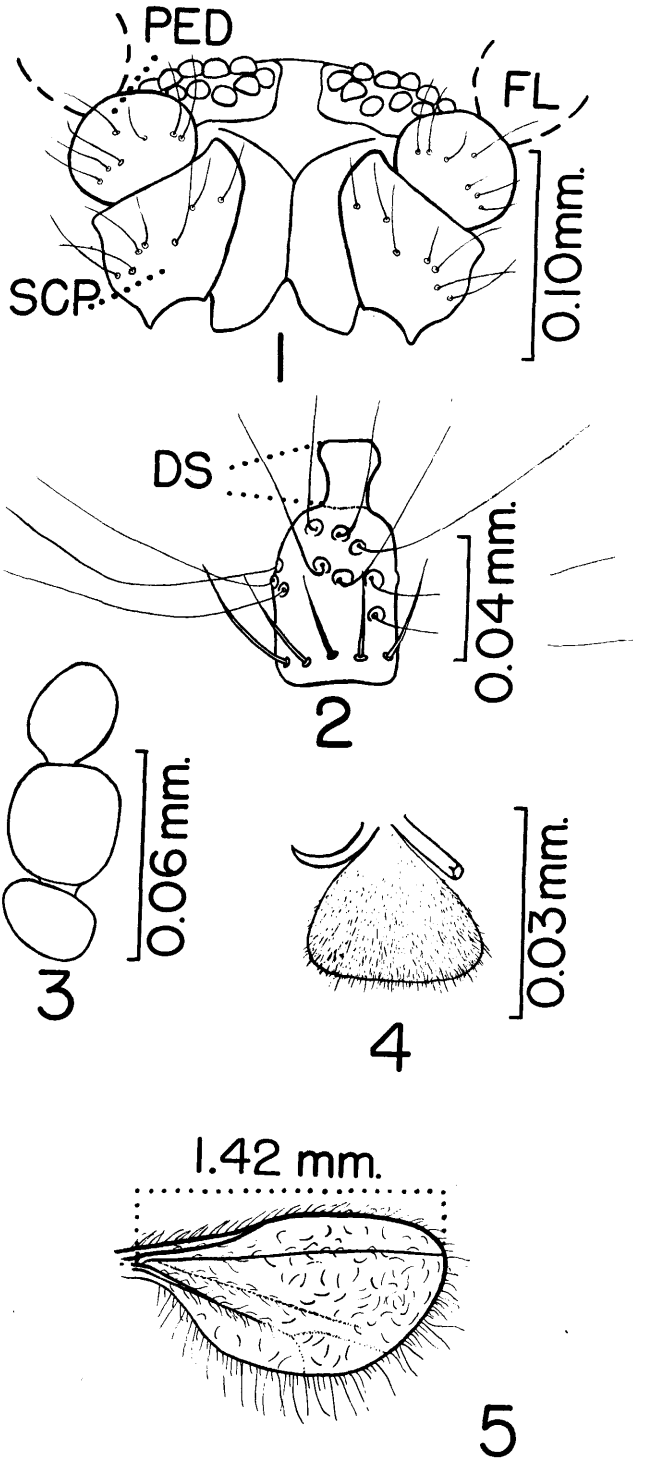
Holotype.—Male, reared from leaf gall on *Juniperus virginiana* 'Canaertii' on May 6, 1962, at the Ohio Agricultural Experiment Station, Wayne County, Wooster, Ohio. United States National Museum Number 67069.

Allotype.—Data same as holotype, at United States National Museum.

Paratypes.—Data same as holotype, 6 males, 2 females at United States National Museum, 2 males, 2 females at British Museum (Natural History), London.

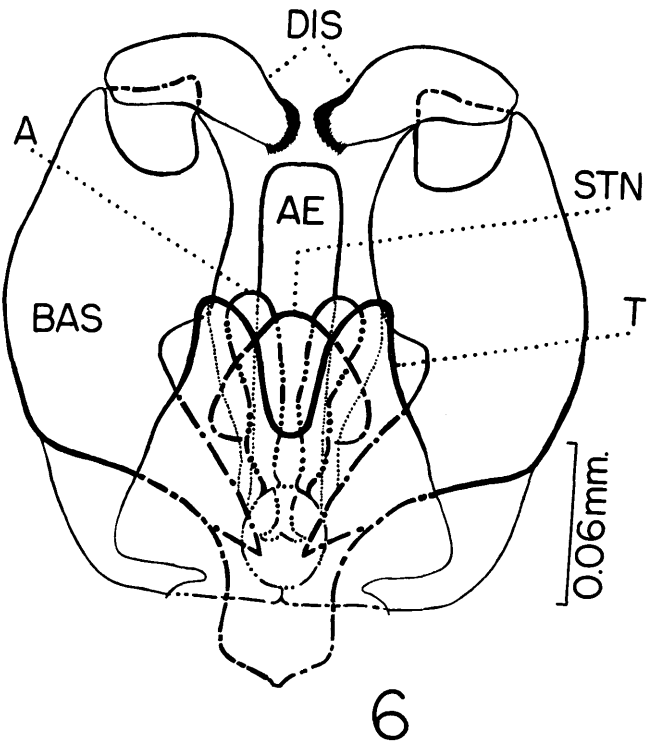
DISCUSSION

To date six species of *Oligotrophus* have been recognized in the United States. Felt (1916) lists five species, including *Oligotrophus betheli* Felt which was reared from *Juniperus utahensis* in Colorado. *O. betheli* was described from one male specimen of a nearly mature fly in the puparial envelope. Upon examination of the slide mount, no structure similar to structure "A" could be found. Felt (1912) stated that *O. betheli* causes a fleshy, apical gall, which we consider to differ from the leaf gall of *O. apicis*. The male terminalia of *O. pattersoni* White (1950) differ from *O. apicis* in having the tenth sternite bilobed, and lacking a structure "A." The dorsal structure of the female terminalia of *O. apicis* differs from *O. pattersoni* in being bilobed and lacking long setae with recurved tips. Many of the older European studies are not illustrated and do not mention key characteristics; thus currently it is difficult to state which European species would be most closely



Oligotrophus apicis sp. n.

FIGURE 1. Dorsal half of head, front view. FL, first flagellar segment; PED, pedicel; SCP, scape.
FIGURE 2. Fifth flagellar segment of male. DS, distal stem.
FIGURE 3. Palpus.
FIGURE 4. Pulvillus and claws, ventral view.
FIGURE 5. Wing.



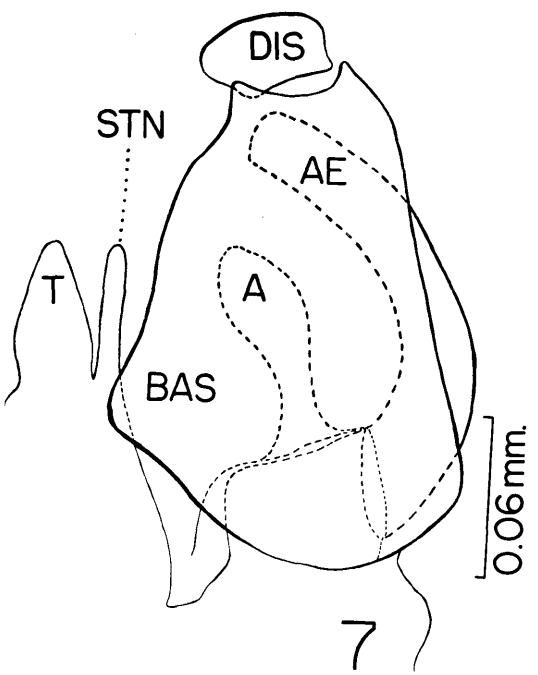


FIGURE 6. Male terminalia, front or dorsal view. A, structure A; AE, aedeagus; BAS, basistyle; DIS, dististyle; STN, 10th sternite; T, 10th tergite.

FIGURE 7. Male terminalia, lateral view. Abbreviations same as in figure 6.

related to *O. apicis*. The name of the species is from the Latin word "apex" meaning of the tip.

LIFE HISTORY

In Ohio *O. apicis* overwinters as a yellow-orange larva (figs. 10, 11) in the branchlet tips enclosed by the terminal leaves. In late April and early May, adults begin to emerge from the tips and lay orange colored eggs on the new juniper

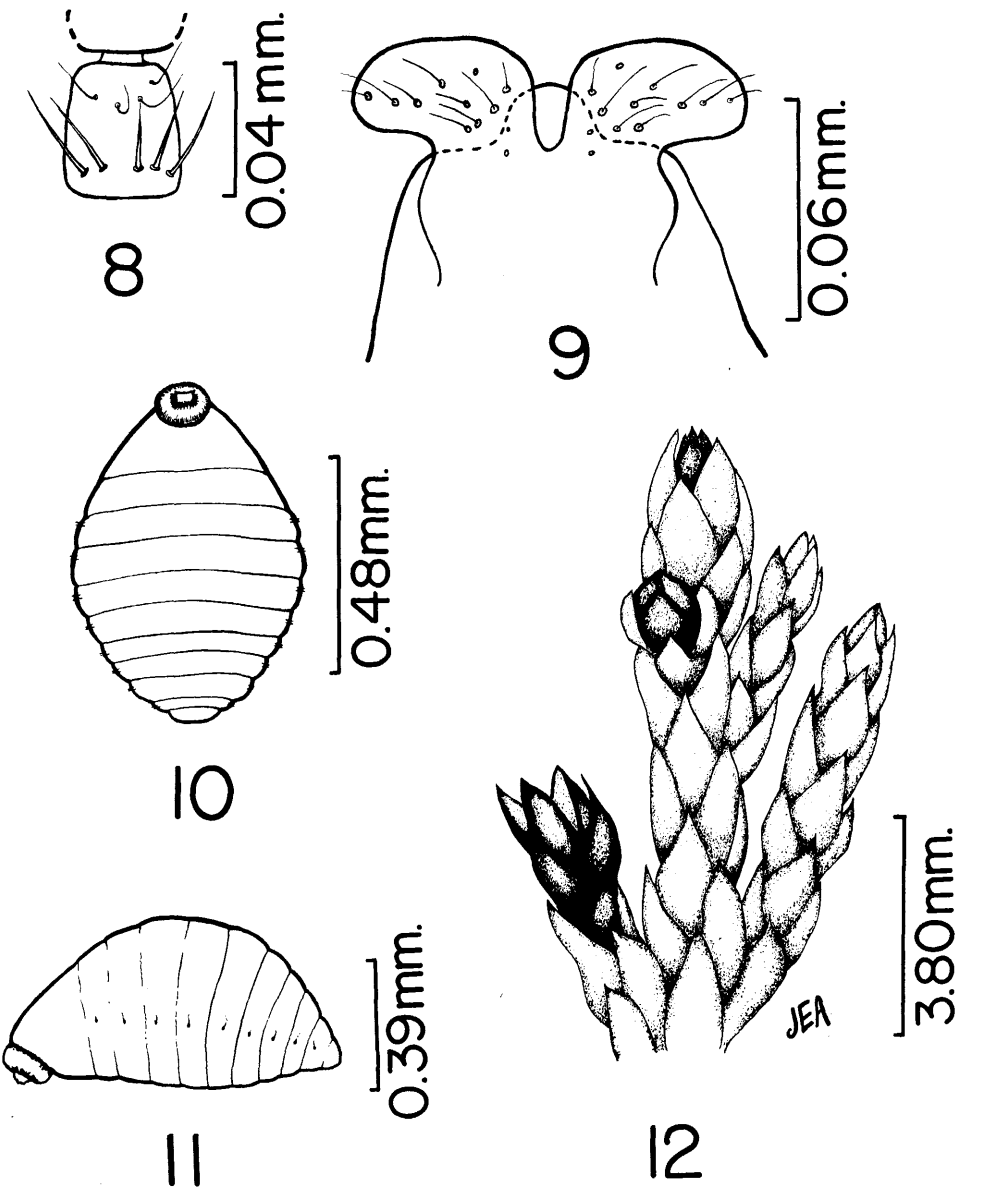


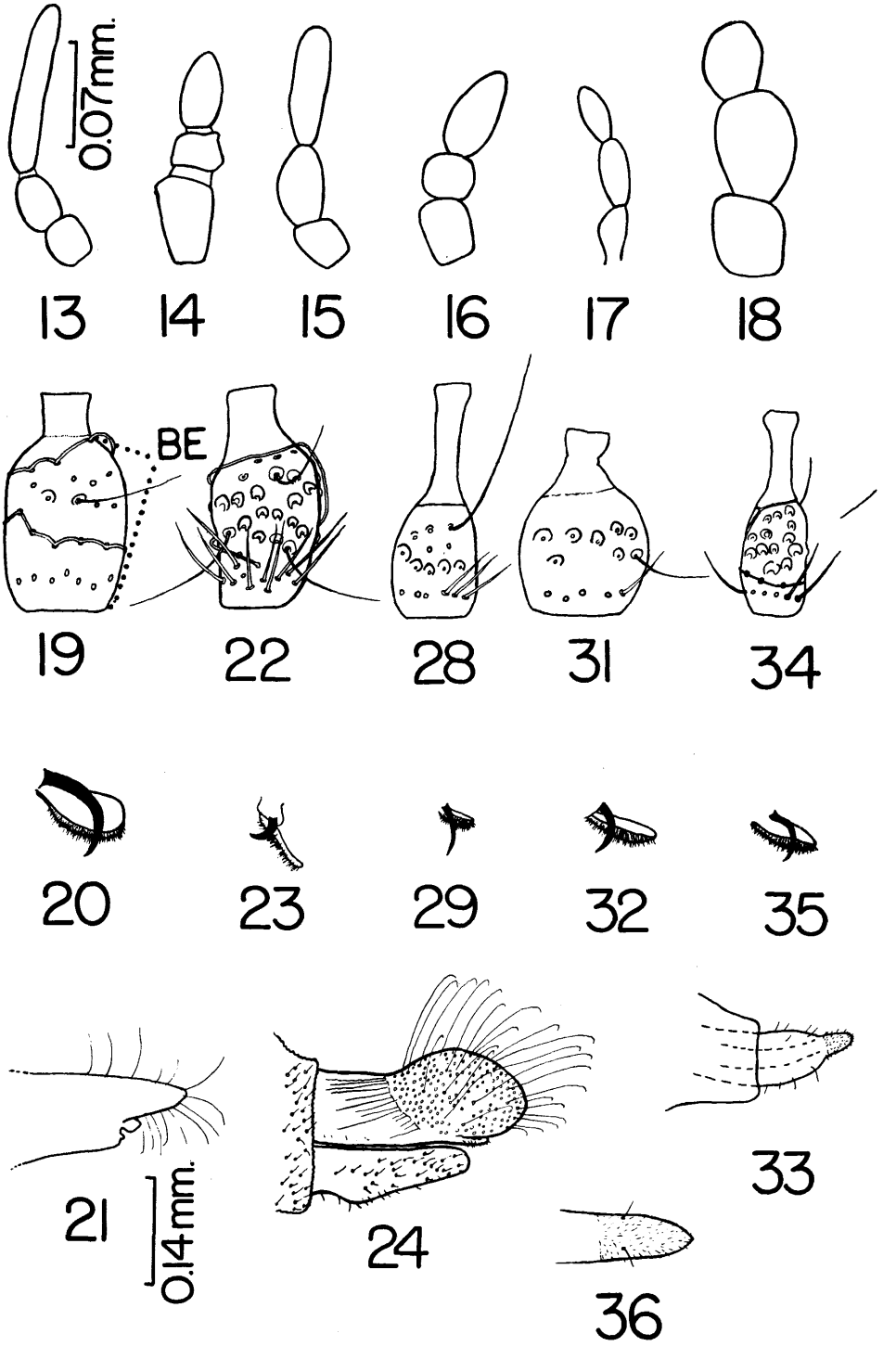
FIGURE 8. Fifth flagellar segment of female. FIGURE 9. Female terminalia, dorsal view.
FIGURE 10. Mature larva, ventral view. FIGURE 11. Mature larva, lateral view.
FIGURE 12. Branchlet of Canaert Redcedar, lower tip shows empty gall, remaining brown tips contain pupae, tips on right are normal.

foliage. Adult life is one to two days. The larvae upon emerging from the eggs crawl to the tips, and move between the terminal leaves to the promeristem. Although several larvae may begin feeding on the promeristem, only one larva develops per tip. Adults are abundant again in late June, and in late summer all stages of the midge can be found. Previously infested tips (fig. 12) soon become brown after adult emergence. Trees which are heavily infested have a brown appearance, making them unsuitable for nursery sale. *Oligotrophus apicis* has been found infesting the following junipers: (Juniper nomenclature according to Wyman, 1963), *Juniperus virginiana* 'Canaertii', Canaert Redcedar; *J. v. pyramidalis* 'Hilli', Dundee Redcedar; *J. horizontalis* 'Plumosa', Andorra Juniper; *J. virginiana cupressifolia*, Cypress Eastern Redcedar; *J. v. crebra*, North Eastern Redcedar; *J. v.* 'Elegantissima', Goldtip Eastern Redcedar; *J. v.* 'Globosa', Globe Eastern Redcedar; *J. v. pendula*, Weeping Eastern Redcedar; *J. v.* 'Schottii', Schott Redcedar; *J. horizontalis alpina*, Alpine Creeping Juniper; *J. v.* 'Smith', Smith Redcedar; and *J. scopulorum*, 'Blue Heaven'. High infestations of *O. apicis* have been found on the first four mentioned varieties. In addition to Ohio, specimens of *O. apicis* were examined from Pennsylvania (Adams, 1963), Michigan (Kluck, 1962), Indiana (Schuder, 1963), and Illinois (English, 1963).

The following key includes the species of *Oligotrophus* recognized as occurring in the United States. Three species were described from one sex, consequently in couplets 2(1), 4(3') and 6(5') some difficulty might be encountered.

KEY TO THE SPECIES OF *Oligotrophus* IN THE UNITED STATES

1 Third palpal segment longer than second (figs. 13, 14, 15, 16)..... 2
1' Third palpal segment shorter than second or nearly the same length (figs. 3, 17, 18).. 5
2(1) Third palpal segment longer than twice the length of second (fig. 13); fifth flagellar segment (seventh antennal segment) of female with distal stem length about ¼ the length of basal enlargement (fig. 19); halteres reddish, transparent; pulvillus extending slightly beyond claws (fig. 20); ovipositor nearly as long as abdomen, terminal lobe slender, narrowly rounded (fig. 21); host possibly basswood, *Tilia americana* L..... *O. vernalis* Felt. (only females known)
2' Third palpal segment not longer thant wice the length of second (figs. 14, 15, 16).... 3
3(2') First palpal segment distinctly longer than second (fig. 14); third flagellar segment of female with stem sessile; third flagellar segment of male with stem slightly less than ½ the length of basal enlargement (fig. 22); halteres yellowish; pulvillus extending well beyond claws (fig. 23); ovipositor short and stout, terminal lobes broadly oval, covered with numerous setae that are recurved at tips (fig. 24); male with tenth sternite cleft (fig. 25); dististyle blunt, slightly curved (fig. 26); causes artichoke-like deformations (fig. 27); on the ends of the smaller branches of Mountain Cedar, *Juniperus mexicana* Spreng..... *O. pattersoni* White. (both sexes known)
3' First palpal segment shorter than second or only slightly longer (figs. 15, 16)..... 4
4(3') Third palpal segment longer than twice the length of the first (fig. 15); fifth flagellar segment of male with stem slightly longer than basal enlargement (fig. 28); claws slender, extending slightly beyond pulvillus (fig. 29); dististyle slender terminally (fig. 30); reared from large terminal rosette gall on goldenrod, *Solidago*, probably *S. canadensis* L..... *O. inquilinus* Felt. (only males known)
4' Third palpal segment shorter than twice the length of the first (fig. 16); fifth flagellar segment of male with stem shorter than basal enlargement (fig. 31); claws not extending beyond pulvillus (fig. 32); ovipositor with short setae terminally (fig. 33); reared from white birch, *Betula* sp., causes winged seed to form a globose gall with rudimentary wings..... *O. betulae* Winn. (both sexes known)
5(1') Second palpal segment nearly the same length as first (fig. 17); fifth antennal segment of male (fig. 34); with narrow stem, shorter than basal enlargement; pulvillus extending slightly beyond slender claws (fig. 35); ovipositor as long as abdomen, tapering, narrowly rounded (fig. 36); reared from red-spotted leaf galls of prairie willow, *Salix humilis* Marsh..... *O. salicifolius* Felt. (both sexes known)
5' Second palpal segment distinctly longer than first (figs. 3, 18); pulvillus extending well beyond claws..... 6
6(5') First palpal segment as long as or longer than third (fig. 18); dististyle stout, slightly curved (fig. 37); reared from fleshy, apical, conical gall on *Juniperus utahensis*..... *O. betheli* Felt. (both sexes known, male in puparial envelope)
6' First palpal segment shorter than third (fig. 3); dististyle moderately slender terminally (fig. 6); reared from Eastern Redcedar, *Juniperus virginiana* L. and many of its varieties, causes leaf galls at tips of branchlets (fig. 12)..... *O. apicis* sp. n. (both sexes known)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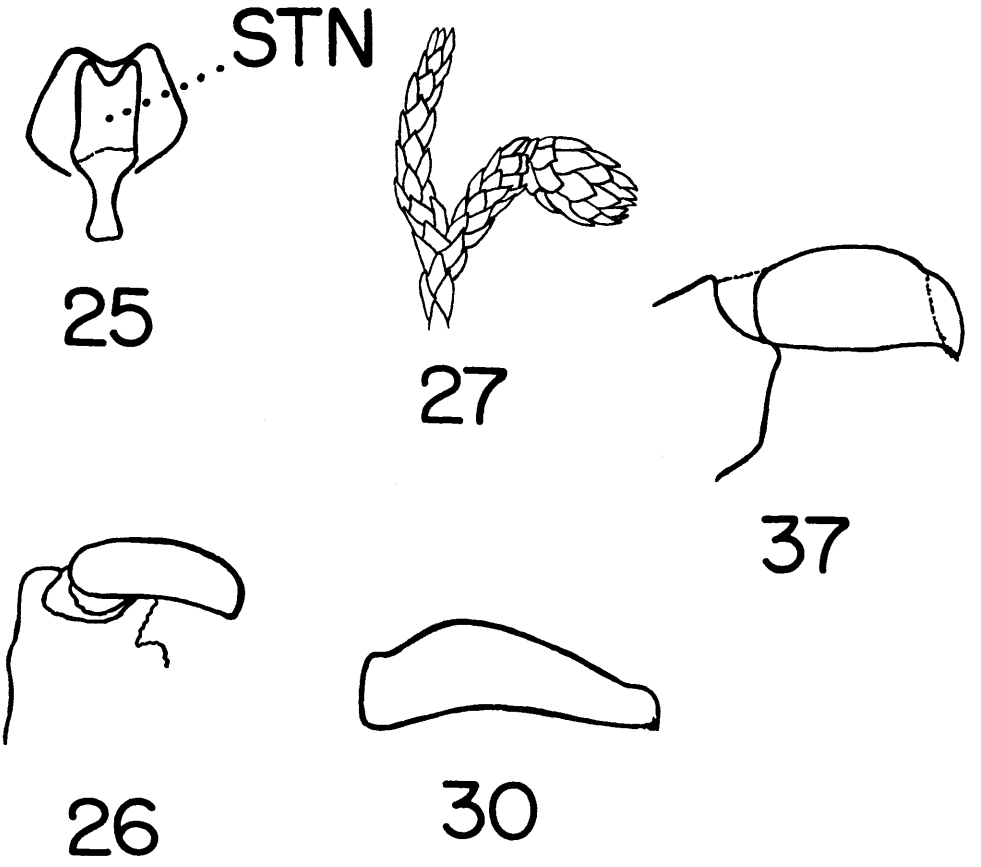

EXPLANATION OF PLATES 4 AND 5

FIGURE 13. Palpus of *Oligotrophus vernalis* Felt.
FIGURE 14. Palpus of *O. pattersoni* White.
FIGURE 15. Palpus of *O. inquilinus* Felt.
FIGURE 16. Palpus of *O. betulae* Winn.
FIGURE 17. Palpus of *O. salicifolius* Felt, redrawn from Felt.
FIGURE 18. Palpus of *O. betheli* Felt.
FIGURE 19. Fifth flagellar segment of *O. vernalis*, female. BE, basal enlargement.
FIGURE 20. Claw and pulivllus of *O. vernalis*.
FIGURE 21. Ovipositor of *O. vernalis*.
FIGURE 22. Third flagellar segment of *O. pattersoni*, male, redrawn from White.
FIGURE 23. Claw and pulvillus of *O. pattersoni*, redrawn from White.
FIGURE 24. Ovipositor of *O. pattersoni*, redrawn from White.
FIGURE 25. Tenth tergite and sternite of *O. pattersoni*, redrawn from White. STN, 10th sternite.
FIGURE 26. Dististyle of *O. pattersoni*, redrawn from White.
FIGURE 27. Branchlet of *Juniperus mexicana* with gall caused by *O. pattersoni*, redrawn from White.
FIGURE 28. Fifth flagellar segment, male, of *O. inquilinus*.
FIGURE 29. Claw and pulvillus of *O. inquilinus*.
FIGURE 30. Dististyle of *O. inquilinus*.
FIGURE 31. Fifth flagellar segment, male, of *O. betulae*.
FIGURE 32. Claw and pulvillus of *O. betulae*.
FIGURE 33. Ovipositor of *O. betulae*.
FIGURE 34. Fifth antennal segment, male, of *O. salicifolius*, redrawn from Felt.
FIGURE 35. Claw and pulvillus of *O. salicifolius*.
FIGURE 36. Apex of ovipositor of *O. salicifolius*.
FIGURE 37. Dististyle of *O. betheli*.

Limited information is known concerning the distribution of *Oligotrophus* species in the United States. A summary of the localities where species were collected or reported is given in table 2.

TABLE 2

Areas in the United States where Oligotrophus *species were collected or reported*

Species	Area and literature reference
O. apicis	Wooster, Ohio; Clyde, Ohio; Columbiana, Ohio; Shade, Ohio; Beech Grove, Indiana; Urbana, Illinois; Saginaw, Michigan; State College, Pennsylvania; (see text).
O. betulae	New Haven, Connecticut; Albany, New York; (Felt, 1928).
O. betheli	Portland, Oregon; McCoy, Colorado; (U.S.D.A., 1957; Felt, 1912).
O. inquilinus	Albany, New York; (Felt, 1928).
O. pattersoni	Austin, Texas; (White, 1950).
O. salicifolius	Karner, New York; Philadelphia, Pennsylvania; (Felt, 1928; U.S.D.A., 1962).
O. vernalis	Karner, New York; (Felt, 1928).

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